Validating the Navy's Selective Reenlistment Bonus (SRB) Model: Progress to Date

Presentation to the Third Annual Navy Workforce Research and Analysis Conference

31 March – 1 April 2003

Carol Moore
Javier Espinosa
Paul F. Hogan
The Lewin Group

Overview

- Purpose
- Background
- Method
- Current Progress
- Next Steps

Purpose

- Validate the Navy SRB Model
  - Model is used to predict number of reenlistments by rating/NEC who take SRB
  - Model predicts budget cost of SRB program
- Diagnose any problems
  - By model component
- Suggest possible corrections or improvements

Background

- Versions of the SRB Model (“Roger”) have been used since the 1980’s.
- Recently, model appears to under-predict, in the aggregate, the number of SRB takers
  - Requires actions to prevent over-expending the SRB budget
    - Reprogramming
    - Temporary program suspension

SRB Model Components

1. SRB award levels, by rating/NEC and zone are taken as given
2. Model determines SRB eligibility
   - Snapshot from the Retention Management System (RMS), derived from the Enlisted Master File
   - Logic is applied to individual personnel in RMS based on
     - EAOS window and zone
     - Rating/NECs
   - Allocation to rating/NEC based on highest award

SRB Economic Model Component

- Financial incentive to reenlist a function of
  - SRB multiple
  - Other military compensation
  - Civilian opportunities
- Annualized Cost of Leaving (ACOL) model
  - Coefficients vary by rating group (DoD occupation)
- Reenlistment rates adjusted for other factors
  - Unemployment rate
- ACOL model based on changes from previous year
  - Adjusted to “pass through” most recent history

SRB Model: Change Formulation

- The predicted reenlistment rate is estimated as a difference from the previous year's rate
  - logit functional form is used
  - coefficients for ACOL, unemployment rate (U) may vary by rating group

$$\ln(r_{j,t}/(1-r_{i,t})) = a + b_i ACOL_{i,t} + b_{i+1} U_t$$

$$\ln(r_{j,t+1}/(1-r_{j,t+1})) = a + b_i ACOL_{J,t+1} + b_{i+1} U_{t+1}$$

$$\ln(r_{j,t+1}/(1-r_{j,t+1})) - \ln(r_{j,t}/(1-r_{j,t+1})) = b_i (ACOL_{J,t+1} - ACOL_{J,t}) + b_i (U_{t+1} - U_t)$$

$$\ln(r_{j,t+1}/(1-r_{j,t+1})) = \ln(r_{j,t}/(1-r_{j,t+1})) + b_i (ACOL_{J,t+1} - ACOL_{J,t}) + b_i (U_{t+1} - U_t)$$

SRB Model

- The model uses the equations to estimate the reenlistment or “take” rate for the SRB
  - Then, the reenlistment or “take” rate is applied to eligibles

$$takers_{j,t+1} = eligibles_{j,t+1} * r_{j,t+1}$$

SRB Model Error

- Actual “takers” can be specified as a “forecast” (denoted “*”) and a forecast error
- Unlike analyses of some forecast equations, we are concerned with errors in forecasting E as well as forecasting “r”

$$Takers_{j,t+1} = E_{j,t+1} * r_{j,t+1}$$

$$E_{j,t+1} = E^{*}_{j,t+1} + \varepsilon_{j,t+1}$$

$$r_{j,t+1} = r^{*}_{j,t+1} + \varepsilon'_{j,t+1}$$

$$Takers = E^{*}_{j,t+1} * r^{*}_{j,t+1} + E^{*}_{j,t+1} * \varepsilon'_{j,t+1} + r^{*}_{j,t+1} * \varepsilon_{j,t+1} + \varepsilon_{j,t=1} * \varepsilon'_{j,t+1}$$

Validation Approach

- Compare actual vs. model predictions
- Determine components of model that appear to predict well/poorly
- Challenge:
  - "Actual" SRB eligible population is not directly observed (i.e., there is not official record)
    - Uncertainty in ***eligible*** population complicates analysis, making comparison of "actual" vs. "predicted" more difficult
- We begin with estimation of eligibles
  - Tests of other components are not definitive if estimation of eligibles is incorrect

Analysis of Eligibles: FY 00

Takers (actual)	15,048
Eligibles (from model)	52,822
SSN match from model	11,442
No SSN match	3,601
Take rate (matched/eligibles)	21.6%
Match rate	76%

Analysis of Eligibles: FY 01

Takers (actual)	20,454
Eligibles from Model	51,622
SSN match from model	15,249
No SSN match from model	5,205
Take rate (matched/eligibles)	29.5%
Match rate	74.5%

Analysis of Eligibles By Zone: FY 00

- Percent of takers matched by SRB Zone
  - Zone A: 80.1% of takers are matched to eligibles
  - Zone B: 69.8% of takers are matched to eligibles
  - Zone C: 70.0% of takers are matched to eligibles

Match rate lowest in Zones B and C

FY00 Zone A Match Rate: Skill Rank

Part

TYPE OF SKILL	SRB SKILL ID	Takers	Takers in Eligibles File	Percent Matched
HM NEC	8466	18	1	5.6%
HM NEC	8479	11	1	9.1%
HM NEC	8489	26	3	11.5%
Dental NEC	8752	13	2	15.4%
HM NEC	8483	76	14	18.4%
HM NEC	8432	27	7	25.9%
HM NEC	8485	14	4	28.6%
LN	LN	22	7	31.8%
HM NEC	8482	56	18	32.1%
HM NEC	8451	51	17	33.3%
ET NEC	14XX	62	31	50.0%
HM NEC	8506	60	33	55.0%
CTO	CTO	89	52	58.4%
STS	STS	164	98	59.8%
MN	MN	18	11	61.1%
PC	PC	65	40	61.5%
STG/AW NEC	7846	16	10	62.5%
CTA	CTA	16	10	62.5%
IT	IT	69	44	63.8%

FY00 Zone B Match Rate: Skill Rank

Partia

TYPE OF SKILL	SRB SKILL ID	Takers	Takers in Eligibles File	%Match
ET	ET	18	0	0.0%
NUC NEC	3393	15	1	6.7%
ET SS NEC	14XX	24	2	8.3%
NUC NEC	3385	11	1	9.1%
NUC NEC	3363	30	3	10.0%
NUC NEC	3353	18	2	11.1%
HM NEC	8479	25	3	12.0%
NUC NEC	3354	15	2	13.3%
NUC NEC	3364	42	7	16.7%
NUC NEC	3365	43	8	18.6%
HM NEC	8425	42	9	21.4%
NUC NEC	3355	23	5	21.7%
HM NEC	8432	28	7	25.0%
NUC NEC	3395	21	6	28.6%
NUC NEC	3394	13	4	30.8%
HM NEC	8541	13	4	30.8%
MT	MT	52	17	32.7%
NUC NEC	3366	15	5	33.3%
CTI NEC	9216	13	5	38.5%
STS	STS	69	27	39.1%
FT	FT	34	15	44.1%

FY00 Zone C Match Rate: Skill Rank

Partial Listing; Zone C Average=70.0%

TYPE OF SKILL	SKILL NUM.	Number of Takers	akers in Eligibles Filrcent	Takers in Elig I
NUC NEC	3394	15	2	13.3%
NUC NEC	3364	50	9	18.0%
NUC NEC	3366	25	5	20.0%
NUC NEC	3395	43	9	20.9%
NUC NEC	3365	48	11	22.9%
NUC NEC	3363	38	11	28.9%
HM NEC	8425	33	10	30.3%
NUC NEC	3393	16	7	43.8%
CTR NEC	9147	10	5	50.0%
HM NEC	8478	15	8	53.3%
HM NEC	8432	17	10	58.8%
NC	NC	78	47	60.3%
CTR	CTR	28	17	60.7%
DC NEC	4811	13	8	61.5%
FC	FC	43	31	72.1%

Analysis of Eligibles: Match Rate by Quarter of SRB Effective Date

Quarter	Rate	Takers
First	85.2%	3,962
Second	77.6%	3,687
Third	74.7%	4,027
Fourth	65.1%	3,372

Analysis of Eligibles: Summary

- Based on two FY's, match rate is low but consistent over time
- Some ratings have much higher error rates than others:
  - Zone A: HM, ET and related NECs
  - Zone B: ET
  - Zone C: Nuclear NECs, HM

Analysis of Eligibles: Summary

- May indicate difficulty in identifying recently acquired NECs
  - Begin-year “snapshot” from RMS gets increasing out of date during the year
- Zone A appears to have a higher match rate than Zones B, C
  - Consistent with problems when sailor picks up additional NECs beyond first term
- First quarter of FY has highest match rate, with rate declining with subsequent quarters
  - consistent with initial RMS data snapshot becoming out of date

Next Steps

- Simulate predictions made for FY 00 and FY 01
  - compare predicted versus actual number of takers by zone, skill number
- Test sensitivity to econometric parameters
- Findings
- Recommendations for Improvement